

“Pop-up” Flash Macro Photography ©

Low cost macro shooting delivering outstanding quality is easier than you think!

Art Vaughan

Outlined here is a process for assembling a cheap but efficient flash reflector bracket that will enable you to shoot macro images using lighting provided only by the standard "pop-up" flash found on many cameras. Using this simple home-made support bracket anyone can produce amazing macro images having true "studio quality" lighting, without the need of a system utilizing multiple flash heads or a ring light, on a factory made support bracket. The set-up described provides maximum portability... great for hunting down and following small insects and spiders that aren't likely to sit still for photographers using cumbersome tripods. The intensity of the flash at short working distances allows the use of very small apertures, a definite "plus" when shooting closeups. This lighting set-up works well with conventional macro lenses, extension tubes, stacked add-on lenses, or any lens and camera combination in a situation where careful control of lighting is required at very close working distances.

The concept of using the macro bracket and direct flash light shield described in this document is based upon the premise that quality lighting for macro photography of small subjects shouldn't cost so much that the average person is economically "locked out" of this interesting activity. Although many factory-made macro lighting rigs are available, they're a bit pricey. Their weight and additional batteries required can be a disadvantage at times. For me, nothing beats "going light" and knowing that camera batteries are the only ones I need to carry.

There are trade-offs involved in using this "do it yourself" macro rig. Unless you have another camera body or small external flash on hand (I always do), should the pop-up flash's tube or capacitor fail, your flash shooting session is over. My camera's flash has cycled several tens of thousands of times, and is still going strong. Setting up to get perfect exposures in certain situations might take a few test shots and on-screen image evaluations. Shooting in the manual mode and focusing by moving the camera forward and backward isn't for everybody. In really high winds, the kind you probably wouldn't want to shoot in, the reflector cards might be a bit unstable.

If you enjoy "do it yourself" projects, then add this rig to your "to do" list. Build the unit as described, or use these instructions as a guide in constructing your "better" version. After a little practice, the results you'll get using just your pop-up flash will amaze you. For all macro shooters, one of the most valuable features offered by new digital technology is the "instant feedback" provided by the camera's screen or electronic viewfinder. Shooting macro with my older film gear was great, but there was always the possibility of discovering missed or blown shots, revealed only when slides or negatives returned from processing. Now we have the luxury of being able to shoot in very difficult situations, instantly evaluate our results, make corrections on the fly, and take full advantage of any photo opportunity. This rig works fine on film cameras, but is a pure pleasure to use shooting digital. Once set up, you can stalk or chase down small creatures, shooting away almost as fast as you want. If your subject is in focus... your flash exposure will be right on... and the lighting effect you choose absolutely repeatable.

Macro bracket / light modifier: Uses only a camera's pop-up flash!

The simple camera-mounted light modification system described on the following pages is an extremely lightweight and inexpensive alternative to much more costly macro lighting units. Made with a variety of cheap & readily available “bits & pieces”, the quality of lighting and the degree of control offered by this rig has to be seen to be believed. Because of its light weight, flexibility, and pop-up flash lighting source, you get maximum “bang for your buck” when working at lens-to-subject distances from two feet down to as little as one centimeter, or even less. Working at moderate to high magnifications can result in very short working distances, often so close that getting light onto your subject becomes very problematic. Using this simple rig you'll have no trouble redirecting the light from your pop-up flash around the end of whatever lens, or combination of lenses you're using.

Its use is very uncomplicated:

Mount the “direct flash shield” onto your lens. Then mount the bracket on your camera's tripod socket, set the angle of the “arms”, position the reflector cards, and start shooting. After a few test shots, screen image evaluations, and any necessary minor adjustments to aperture, shutter speed, ISO, or reflector card positioning, you can “fire away” as long as you like. Adjusting the angle of one, or both cards offers a high degree of contrast, shadow, and detail control. Using larger reflectors will provide light with softer shadows. Smaller reflectors will give harder edged shadows. When positioning the reflectors be careful that they don't contact anything in front of the lens. It's easy to have a small insect or spider spook and disappear because a reflector card touched its perch or web. You can produce various colored effects or change the amount of light reflected by covering the cards with different materials. Many times swinging one reflector away entirely works well... giving strong directional lighting and increased contrast.

The macro-bracket set-up consists of two assemblies: a camera mounted *reflector and support group*, and a “*direct flash*” *lighting shield* that mounts just like a lens cap onto your outermost lens, whether it be an add-on, or your primary lens. The light from your pop-up flash fans out from the strobe, strikes the reflector cards, and is redirected around your lens onto the subject. The lens-mounted shield prevents direct flash light from striking the subject. Working at very close distances, the intensity of the pop-up flash would severely overexpose any shot. In some situations where a high magnification add-on lens is used, the working distance can be short enough to where the lens itself prevents direct flash lighting from falling on the subject.

There's no need to break down the bracket after a shooting session. Simply leave it assembled with a wing nut as a “keeper” to hold the mounting knob and washers together after removing your camera. It can fold up for packing, becoming a fairly small package. For most efficient storage in a back-pack leave the knob and washers together, removing the support rods, clothespins, and reflectors.

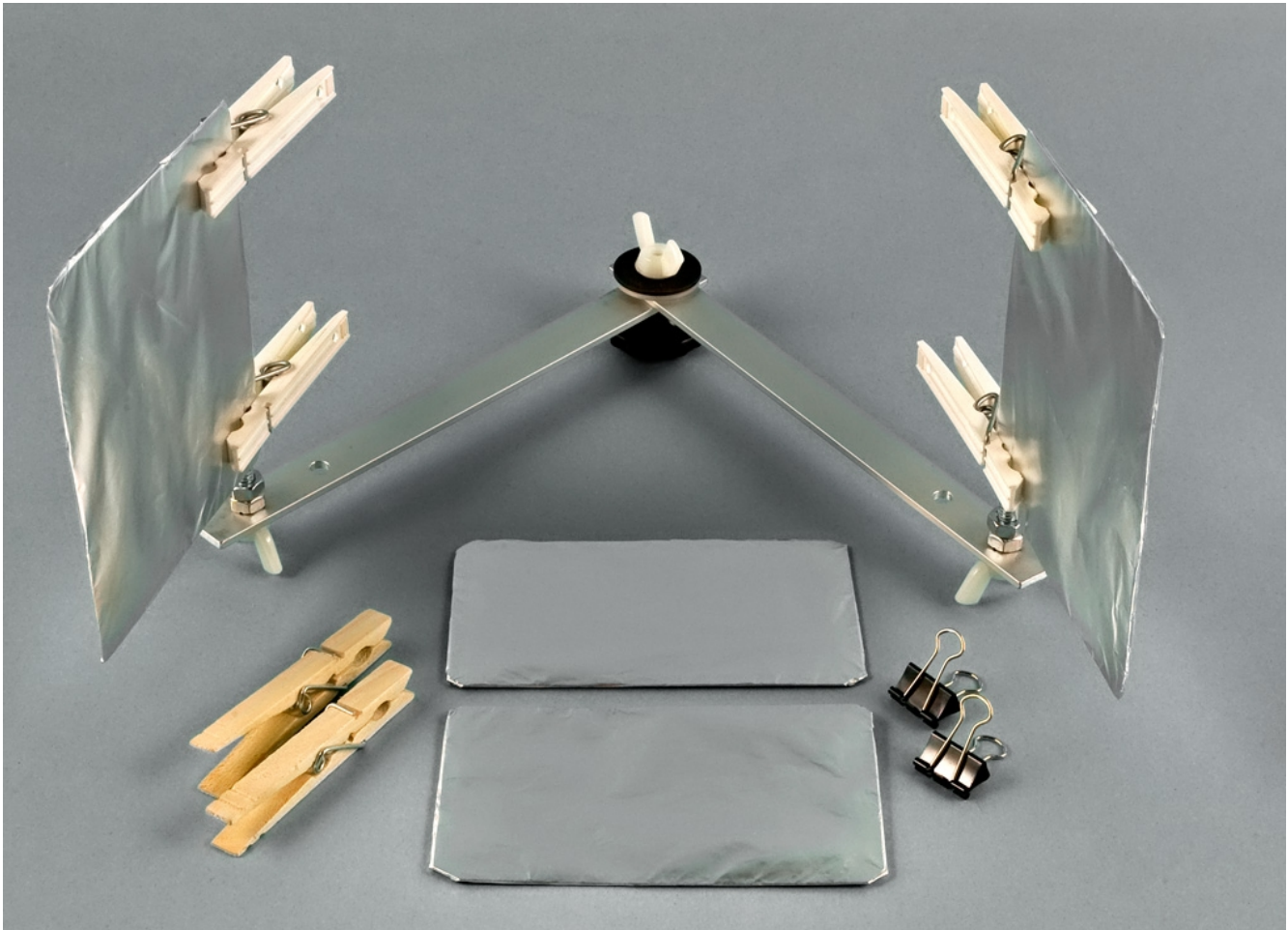
Original design, 2010...

Made using a Staples "Oxo" brand 16' folding ruler (no longer available), and "Flex Neck" clip-on reading lights (difficult to find) as reflector supports. Here it's shown with an early version of a "direct flash shield" (since redesigned). Because some materials used in this version have become tough or impossible to get, I've provided instructions for assembling a bracket using generic materials available almost anywhere.



My “new design” bracket...

Shown with a wing nut “keeper” on the camera mount knob, mounted standard reflectors, extra “mini” reflectors, binder clips, and spare clothespins. The small binder clips are for mounting reflectors when they’re positioned closer to the camera body, causing the longer clothespins to crowd your shutter button hand.



Covering thin cardboard with aluminum foil, dull side out, makes reflectors that provide one stop more illumination than bare white cards. Having the shiny side out makes the cards perform more like mirrors, resulting in hard edged shadows and annoying reflected “hot-spots”. The large size of the cards relative to the sometimes tiny subjects I photograph gives lighting that has true “studio quality”, similar to lighting you get when working in a studio with large soft boxes, umbrellas, or diffusers. In some cases you can’t even tell flash has been used. Lighting ratios can be regulated simply by swinging one or both cards in or out, or bending them up or down slightly. By adjusting the card and support arm angles you can provide lighting in situations where your lens is as close as several millimeters from your subject. This lighting setup works great at lens-to-subject distances ranging from about 2 feet down to less than $\frac{1}{4}$ inch, providing a quality of lighting at high magnification that’s hard to beat at any price.

My "Mini" bracket...

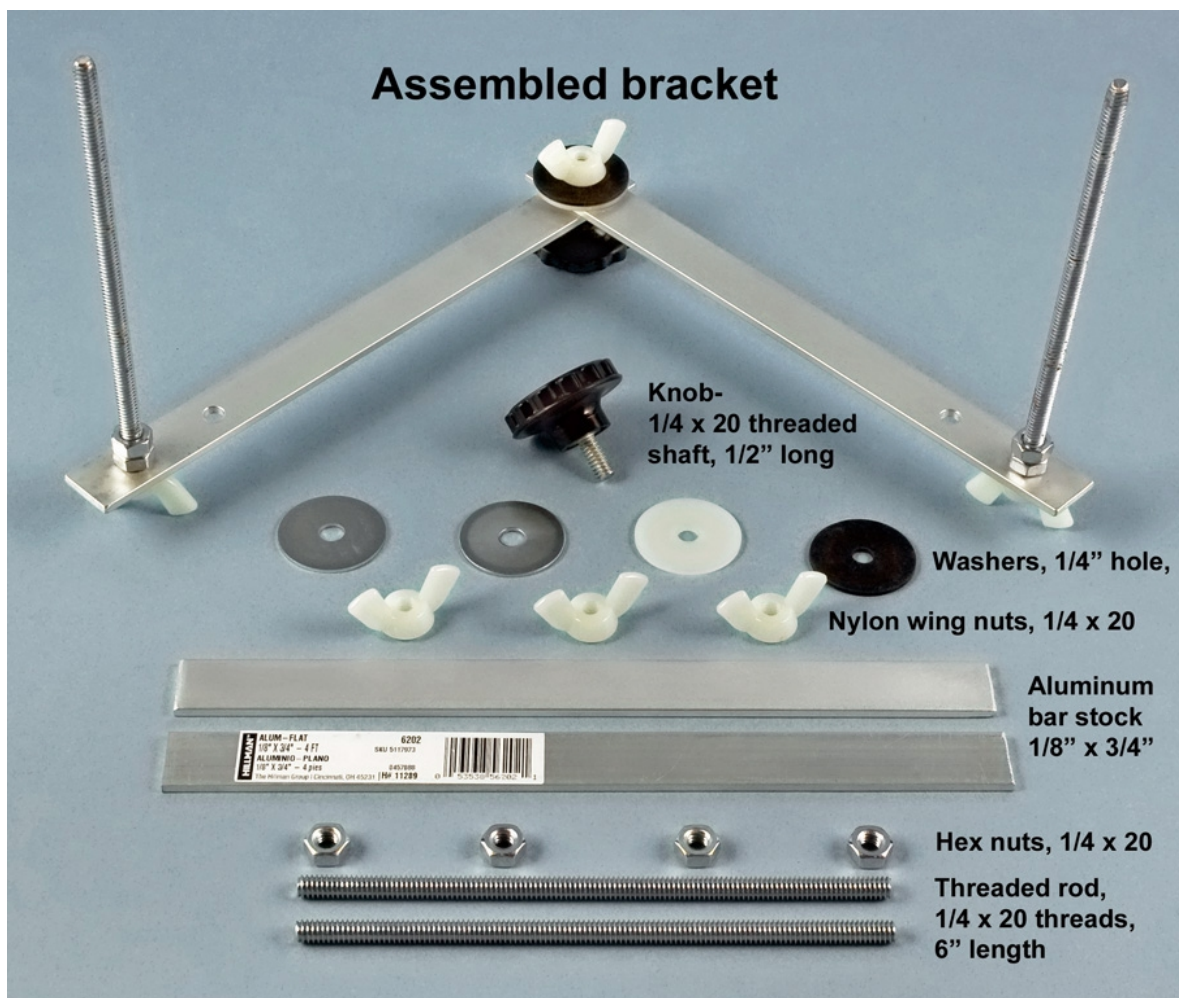
This is for working at very close distances with high magnification lenses and objectives, or on the tripod mount of a Canon MP-E 65mm macro lens. Here it's shown with a Nikon 20x comparator lens on a D60. The direct flash shield was left unmounted for the photo.



Working distance with some lenses can be so short that the end of the lens actually serves as its own flash shield. Binder clips are used to hold the reflectors because longer clothes pins used with shorter bracket arms crowd my shutter button hand. For this application, small 1/4 x 20 female knobs are used to mount the reflector support rods. I was photographing a subject on a table top, and focusing by sliding the camera bracket forward and backward on the smooth table surface. Nylon wing nuts would have worked as well. The reflectors are set wider than normal for this photograph. Here, this unusual lens is mounted on the body with a Nikon F to T-mount adapter that I modified to accept its totally non-standard threaded mounting ring.

Make your own pop-up flash macro bracket...

Excellent brackets can be made using two pieces of thin wood or aluminum having $\frac{1}{4}$ " holes drilled to allow camera and reflector support rod mounting. The threaded rods have replaced the flex-neck reading lights used in my previous design. Here are the parts that I use to put my "new design" brackets together...



Bracket parts list:

#Req: Item & source:

- 1... Flat aluminum bar stock, 1/8" x 3/4", available in 4 ft lengths at most hardware stores for around \$8. This will provide more than enough material to make several brackets. I've found that a bracket arm length of 9" is very convenient, plenty long enough for most macro shooting inside of 18". Don't buy the "anodized" material... it costs more.
- 2... Threaded rod, 1/4 x 20 threads, 6 inches long. These are used for supporting reflectors on the bracket arms. Available at Lowes, 92 cents each.
- 1... Knob, 1.5 in. diameter with 1/2 inch shaft, 1/4 x 20 threads, @ Ace Hardware for about \$3.
- 1... Fender washer, steel, 1.5 in. diameter, with 1/4 in. hole, @ Ace Hardware, Lowes, for about 25 cents. These are optional, used as shims for knobs having a longer threaded shaft.
- 1... Nylon washer, 1.25 or 1.5 in. diameter, with 1/4 in. hole, @ Ace Hardware, less than \$1.
- 1... Fender washer, neoprene, 1.25 or 1.5 in. diameter, with 1/4 in. hole, @ Ace hardware, less than \$1. These provide soft compression when mounting the bracket on the camera, preventing the bracket arms from loosening suddenly once the knob is tightened.
- 4... Hex nuts, 1/4 x 20 threads, for making two "jam nuts"... @ Lowes, packet of 25 for \$1.57.
- 3... Nylon wing nuts, 1/4 x 20 threads, for mounting reflector support rods... Lowes, 80 cents for two. Nylon mounting nuts have some "give" when mounting the rods, and are unlikely to loosen unexpectedly, as when using a metal wing nut with its "hard" mounting.
- 2... 4 x 5 in. cardboard, (or whatever size you want to work with), covered with aluminum foil, dull side out. Thinner material can be flexed and shaped a bit to provide more focused light when needed. I have several sets of foil covered reflectors: 6" x 8" for soft lighting at longer working distances, and 4" x 5" for most subjects down to a working distance of about 1". I also have 2" x 3" reflectors, and even smaller ones, for really tight spaces, or when the working distance shrinks to 1/2" or less when using reversed movie camera lenses or microscope objectives.
- 4... Plastic or wood clothespins, to hold reflector cards on threaded support rods. Plastic pins have better gripping power than wood. The pin is used to press the reflector against the threaded rods, providing good, fairly rigid, yet adjustable support.
- 2... Small binder clips... use in certain situations instead of clothes pins to mount reflector cards on support rods. These are VERY strong, and will hold the reflectors quite firmly, making adjusting card angles a bit more difficult, so use one only per card.

Camera Mounting Knob assembly detail:



I keep a quick-release plate on the bottom of my cameras, using the plate's extra tripod hole to attach the bracket. Constant tightening and loosening of the knob could accelerate wear on the camera's tripod mount threads. The neoprene washer gives a slightly "spongy" grip, preventing the knob from loosening. When removing the bracket from the camera, make sure the rubber washer doesn't remain stuck to the quick release plate. The nylon washer allows for smoother angle adjustment of the bracket. There's no need to tighten the knob to the point where the "arms" are locked into a condition of absolute immobility. I find it useful sometimes to have an amount of tension that allows some adjustment by simply pushing them in or pulling them out. The knob shown has no provision for tripod mounting. All my shooting is done hand-held, bracing and steadying my arms on anything that's handy. In a situation where camera motion seems to be a real problem, I might support the camera using a stick I pick up along my walk. On those occasions where I've lugged a tripod along, the camera doesn't get mounted on it. The tripod legs are used to provide something to brace my hands or arms against while shooting.... very convenient when following a small moving subject. Sometimes I'll stash the tripod out of sight somewhere, to be retrieved later, and just go with a short stick. The bracket could easily be modified to allow tripod mounting for those folks who find shooting unsupported at very short working distances a bit difficult. Using a Nikon PN-11 tube, or something similar, can be convenient because it comes with its own mount, allowing the entire assembly to be tripod mounted if you feel it's necessary.

Construction details:

Bracket arm work...

Cutting... Using a hacksaw, cut your bar stock to a convenient length, then deburr the cut edges with a fine file, emery paper, or fine wire wheel. Arms about nine inches long work well in most situations.

Drilling... Mark the position of the camera mounting knob hole, as well as the holes for reflector rod mounting. You can put several holes along the length of each arm, allowing you to change the rod positions when working distances vary. I start off with a small bit, working up in size, and finishing with a 1/4 inch bit. Using a variable speed drill, I go slowly to avoid excess heating, and to keep the “broadcasting” of metal shavings under control.

Deburring... Using a tapered conical stone on the drill, or a small hand-held rat-tail file, carefully deburr / burnish the rims of the holes. This makes it easier to insert the reflector support rods, and looks better too.

Finishing... I usually put a fine wire wheel on the drill to remove the dull factory finish of the bar stock, brightening the look of the bracket, and making it appear a bit like a pricy, store-bought item.

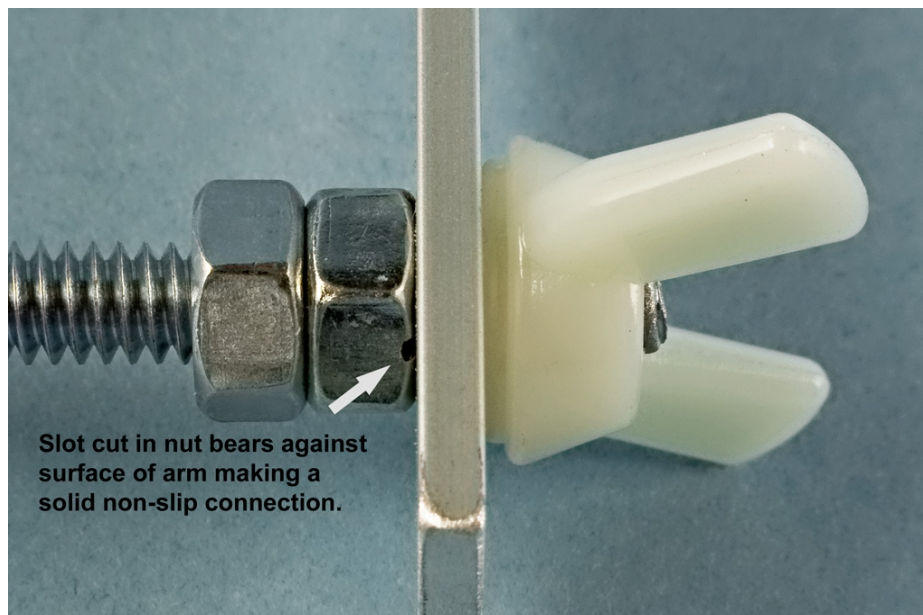
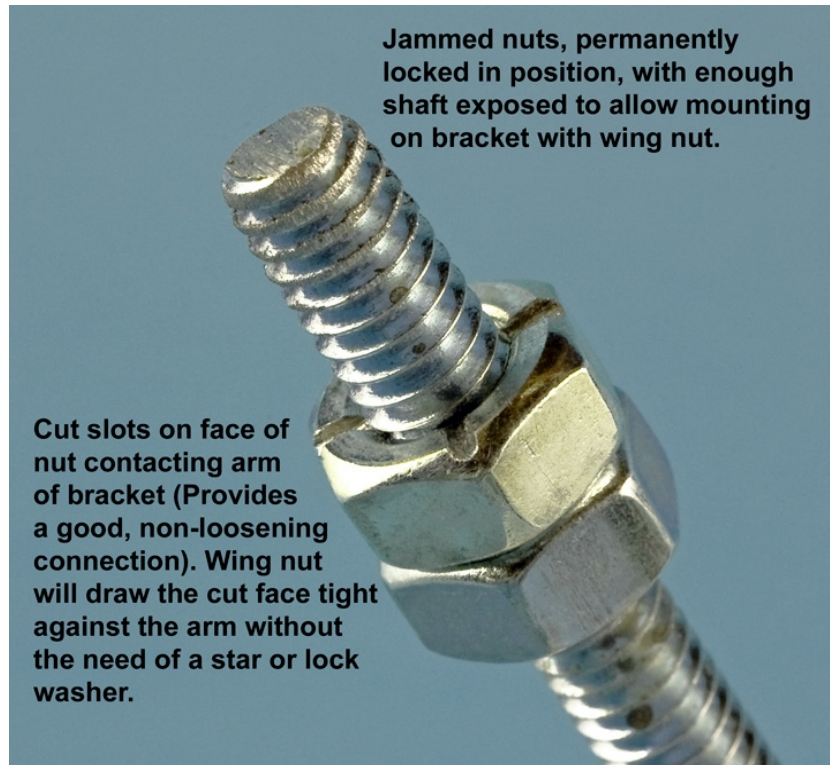
Reflector support rod work...

Grooving... Using a vise to hold them, with a hacksaw cut two shallow grooves at right angles to one another on one face of two nuts. These will form the bottom of the jam nut and seat firmly against the bracket arm when mounting the rods.

Measuring... Screw an ungrooved hex nut onto a rod and insert it into a bracket arm hole, setting its distance in from the end so that enough rod can extend through the arm to allow screwing on and tightening a wing nut... around 3/8 inch. Remove the rod, then apply a reference mark at the point where the bottom face of the nut sits on the rod. This is the distance along the rod at which the grooved surface of the “jam nut” will make contact with the top surface of the bracket arm. Add a grooved nut, slotted face toward the end of the rod, and gently snug it up against the first nut. Screw in the pair until the grooved face of the bottom nut just clears the reference mark. Then, using two small wrenches, screw both nuts toward one another, applying enough torque to firmly “jam” them, being careful they don't travel down the rod a bit in the process... below your reference mark. Once jammed tight, they should never loosen. Now securely mounting a reflector support is simply a matter of inserting the rod to the limit set by the jam nut, and screwing it tight with a nylon wing nut. To remove, loosen the wing nut a bit and rotate the rod.

Reflector support rod detail...

After determining the final position for the reflector rod jam nuts, use two wrenches to turn them toward each other, locking (jamming) the nuts permanently in position on the rod.



Direct flash shield and “bowl” diffuser...

Here are two items used with the macro bracket. One is necessary... the direct flash shield, the other is a nice option... the frozen dinner bowl flash diffuser. Both are adapted for mounting on the front of a lens using a Raynox UAC2000 snap-on lens adapter. It allows mounting their macro lenses (and now my attachments) on any lens having a filter ring between 52mm and 67mm. It fits on like a lens cap by pressing two tabs. This convenient adapter is the 43mm model supplied with their DCR-150 and DCR-250 macro lenses, and is available separately (lensless). If focusing your lens results in the shield or diffuser rotating away from its position directly in front of the pop-up flash, simply squeeze the two mounting tabs and reposition the shield.



The diffuser is made from the plastic bowl that comes with a Marie Callender or Healthy Choice “steamer” frozen dinner. It provides diffused pop-up flash lighting, with soft edged shadows. Clipping a small piece of black paper or plastic on the back of the diffuser allows you to selectively block a portion of the flash, creating directional soft lighting, adjusted by moving the material right or left. Bowls from any dinners having tomato sauce shouldn't be used. Even after vigorous scrubbing, running through a dish washer, or soaking in a variety of cleaners and solvents, an orange stain will remain. This will produce a color shift in your images. Most other varieties are OK, their bowls being completely neutral, as with the one in this photo.

UAC2000 adapter... B&H Photo, \$7.95.

Flash shield material... Staples “M by Staples” Arc System Tab Dividers, black polypropylene, 5-5/6” x 8-1/2”, a package of five... \$3.99 at Staples.

“Steamer” dinners... most large supermarkets, around \$2.89.

Small machine screws, washers, and nuts... 9 of each, for assembling the flash shield and bowl diffuser.

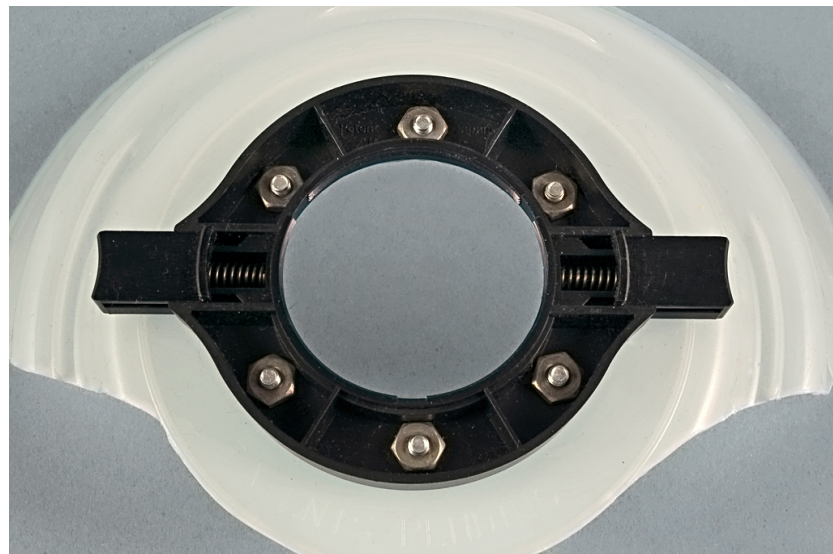
Direct flash shield...

Made from a piece of Staples polypropylene tab divider material attached to a Raynox UAC2000 snap-on macro lens mount. For use with most pop-up flashes, cut a rectangle of black tab material measuring 3.25" x 5 ". If you intend to use a shoe mounted external flash, extend the length of the shield material to allow for the greater height of the flash unit. Trim one end of the piece as shown... to fit around the hole where a Raynox macro lens normally goes. Cut carefully to avoid any material from extending into the lens opening. Keeping this hole completely clear will enable you to fit a Raynox lens in the snap-on mount as it usually would, if you get one in the future. From the back, drill small holes through the adapter for the screws used to attach the shield material. Holes should be centered in the small cavities on the back of the adapter, allowing room for small nuts to be applied to the screws. Backing the screw heads with washers will provide better support for this flexible material.



Frozen dinner “bowl” diffuser...

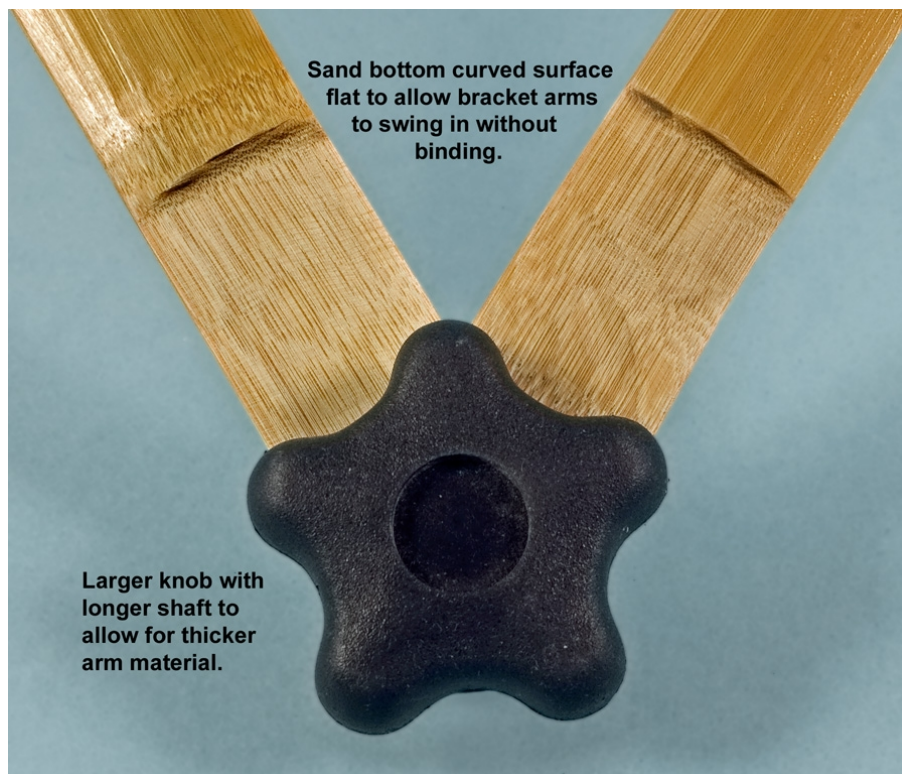
This handy diffuser makes use of the same Raynox UAC2000 snap-on lens adapter used for the shield. The best method I've found for cutting and shaping the plastic is to use small curved scissors used for embroidery, and do final trimming with an Exacto-knife fitted with a sharp (new if possible) blade. To ensure accurate positioning of drilled screw holes, I center the flat surface of the adapter against the outside bottom of the bowl, taping it in place. When drilling through the adapter, GO SLOW!! I hurried on one occasion and split the adapter. Trimming away the material on the lower half of the bowl will permit close low-angle focusing (as on a table top), otherwise it can be an obstruction. Taping or clipping a small piece of black paper or thin black rubber “waffle” shelf liner material somewhere along the curved outside surface of the bowl will allow you to provide directional soft lighting.



For budget-minded photographers who don't like working with metal:



Bamboo is very light, durable, easy to work with, and extremely hard... almost as good as aluminum. Thicker material means a knob with a longer shaft is necessary.



About add-on lenses:

Exposure variation... Using front-mounted supplementary lenses doesn't result in any loss of light. Components mounted between the camera body and your primary lens are “light robbers”.

Magnification... 1x, 2x... 5x, or what? How much “x” do you need???

An easy way to deal with this question is to forget the “x” factor and think in terms of what each add-on lens gives you for field width when used with various primary lenses. When preparing to go shooting I consider what field width range I want to work with, and carry several supplementary lenses that will cover it. Some can be stacked, serving “double duty”.

Focusing... Some add-on lenses are quite heavy and will severely stress most auto-focus mechanisms. Use manual focus and save auto for your more conventional shooting. All my focusing is done simply by moving the camera forward or backward until the subject is sharp. When I find a subject it usually gets photographed at low magnification, then for detail shots I shift to an add-on lens having a narrower field of view. All of my stackable lenses are adapted for 52mm ring mounting... the diameter found on four of the primary lenses I use. Any add-on having an aperture ring is used wide open.

Optical quality and lens “matching”... There's an endless variety of lenses that can be used as add-ons. Not all are good optical matches for some primary lenses. Many give outstanding results, others... not so great. Some are absolutely dreadful..... “dogs” no matter how they're used. Never give up on a lens until you've tried it on ALL your primaries that you do close-up shooting with. I almost tossed out what performed miserably on several lenses running from 50mm to 105mm, only to discover that it was a perfect optical match for use on a 200mm Micro-Nikkor. Some of the objectives below were scavenged from lenses of similar focal length, but from different makers. Although they may offer the same magnification, they produce different out of focus area effects, or vary as to curvature or flatness of field. They can be “swapped out” to fine-tune “bokeh”.



Some of my more useful supplementary lenses...

Nikon 3T and 4T close-up lenses: These are two element highly corrected close-up diopter lenses offering great image quality. Now discontinued, many manufacturers make similar products. These are used singly, stacked together, or combined with other add-on lenses.

Raynox Macro Conversion Lenses: Raynox makes a line of very high quality add-on lenses in various strengths. Using their UAC2000 universal adapter, they snap onto any lens having a filter ring sized from 52mm to 67mm. The DCR 150 and 250 are the easiest to work with, having the greatest working distance. The MSN 202 is a bit challenging to use, with a much shorter working distance. The lens to subject distance of the MSN 505 is extremely short... tough to handle when working with a moving subject. I regularly use a DCR250 and MSN202, and their clarity, contrast, and sharpness is outstanding. Here's a link to the relevant Raynox web-site page: http://raynox.co.jp/english/digital/d_slr/index.html.

Slide Projector Lenses: Many fixed focal length slide projection lenses make high quality macro lenses when used reversed. My favorite is an old Kodak Ektanar C 102mm f: 2.8 from a broken Kodak Carousel slide projector. With a little work a 52mm reverse adapter can be fitted to the front (lettered) end. The excess barrel length at the other end is trimmed back with a small hacksaw to within about ¼ inch of the lens surface. This allows more room for light to be directed around the end of the mounted lens onto the subject.

Movie Projector Lenses: Fixed focal length versions are great for high magnification shooting. Use these reversed to get any kind of useful working distance. Depth of field will be extremely shallow. Here's a Bell & Howell 1 inch focal length "Incelite" f: 1.6 projection lens found on many old Bell & Howell regular 8mm movie projectors. Mine came from a broken projector someone was discarding. Here its mounted in an adapter made from a balsa-wood disc mounted in empty filter rings, with hardware store rubber grommets to keep the lens parallel with the disc. The small end goes toward the subject. The large end toward the camera... with two more empty rings to prevent contact with the primary lens.



Movie Camera Lenses: Lenses with focal lengths from roughly 1" to 1.5" are very useful when used reversed and yield excellent results. These can be very difficult to use due to their *extremely* short working distances. Depth of field will be very shallow and focusing while hand-holding will be quite a challenge. One of my favorites is an old Soligor "Elitar" 38mm f:1.9 telephoto from a Sanyo 8mm movie camera. Another is a Taylor-Hobson "Super-Comat" 1" f1.9 lens from an old Bell & Howell 16mm movie camera. When reversed, these lenses have a tiny objective facing the subject... 1/4" to 1/2" in diameter. Despite their small aperture they do not vignette severely when used on a 105mm lens mounted on a 2x teleconverter.

Enlarging lenses: My wet darkroom days are over, but my enlarger's lenses live on, serving as very high quality macro add-on lenses... used reversed with the aperture wide open. One of my favorites is an old 7 ½ inch (190mm) Bausch & Lomb 5x7 enlarging Tessar made in 1940. This is a heavy uncoated lens that produces great results when stacked on a 105, and gives a bit more magnification, and closer working distance than with the Nikon 4T. For extreme sharpness and flatness of field, any focal length *APO-Rodagon* enlarging lens is outstanding. Almost any enlarging lens works well, but some older ones may have lower contrast than lenses with more modern coatings.

Lenses in Shutters from old folding cameras: These can be great macro add-ons when used reversed with the aperture wide open. If the lens has front-element focusing, set it at infinity. Look for old anastigmats, Tessars, Velostigmats, etc. This ancient (1920's?) 7 inch Triple Convertible Velostigmat performs well on a bellows with three stacked Zeiss "Proxars", and by itself as a reversed add-on.



Front lens cell (objective) from junk zoom lenses: (My favorites) Almost always of very high quality, they work just like a close-up lens. These should be used reversed to give the flattest field and sharpest resolution. Good examples are front cells from macro-focusing zooms. Excellent choices are objectives from Soligor 90-230mm and 75-260mm zooms.

Microscope objectives: These generally have extremely short working distances and paper-thin depth of field. Most will produce vignetting that can be cropped away. The easiest to use are those having relatively low magnification and wide apertures.

Special Adapters:

Macro Reverse Adapters: These are used for reverse mounting another lens face-to-face on your camera's lens, and are probably the most useful item to have in your macro "kit". Common sizes: 52-52mm, 52-55mm, 52-58mm, with a great many other size combinations available. Order from Adorama, B&H photo, or on-line. Ebay is a good source of inexpensive reverse adapters. Always buy metal with ribbed or knurled edges, not plastic! These will last forever, be easy to remove, and cost about the same as any plastic ones you'll come across. Also, plastic rings on metal can jam... always at a bad time.

Step Up / Down Rings: used for fitting add-on lenses with particular sized mounting threads to lenses having larger or smaller sized threads. Available from Adorama, B&H photo, and on-line. As with the reverse adapters... go with metal versions.

Raynox "Universal" adapters: Several close up lenses offered by Raynox come with their "UAC2000 Universal Adapter" snap-on adapter that is designed to fit lens filter rings of 52mm through 67mm, a neat, almost "one size fits all" solution.

RMS to 52mm Thread Adapter: for fitting a microscope objective having the standard "Royal Microscopical Society" thread to lenses having 52mm filter threads. Mine is a machined aluminum disc with the outer edge threaded to fit 52mm, with an RMS threaded hole in the center. My first was a simple disc made from a piece of mat board, having a hole cut in the center into which the threaded portion of an objective was screwed or press fitted. Available on-line to match a variety of lens filter thread sizes.

Home-made "anything goes" adapters: Some add-on lenses you encounter seem to be unusable without expensive machine work being done. This is when you have to use a bit of creativity. A visit to a hardware or craft store might be necessary. I've made lens adapters from paper mailing tubes, PVC pipe, sump pump fittings, toilet tissue tubes, parts of plastic pill bottles, 35mm film cans, "Pringles" potato chip cans, etc. All sorts of stuff can be adapted to mount an unusual lens onto a filter ring that will then allow it to be screwed onto your regular lens. The method you use to mount an auxiliary lens onto your primary lens doesn't have to look pretty! Functionality and final results are what counts. Mini-bungee cords are almost indispensable at times.

Bellows rail / focusing units: All the techniques and equipment mentioned in this document can work well with bellows units mounted directly on a camera body, but non-automatic versions present special problems when shooting "free-hand". I have rigged a standard lightweight (non-auto) bellows for for hand-held use with pop-up flash, but it's difficult to use. You have to pre-set the shooting aperture, which produces, at higher magnifications, a very dim viewfinder image, requiring the use of a small high intensity LED flashlight pre-aimed to illuminate the area of sharp focus in front of your lens. This is only practical after testing to establish the aiming point for this manual "focus assist" light. Auto bellows that offer full open aperture focusing, stopping down only when firing the shutter, eliminate this problem, but are expensive. Using any bellows unit along with the macro bracket results in a significantly more bulky rig that can be very difficult to "aim" at higher magnifications. Locating your target in the viewfinder can be almost impossible at times, and depth of field when using any significant bellows extension will be exceedingly thin. The final image in the group of sample photos was taken using this adaptation.

Examples photographed using this bracket:

All images shot hand-held using pop-up flash only, with 4"x 5" foil covered reflector cards. Focusing was done manually by moving the camera toward or away from the subject until the viewfinder image was at its sharpest. More examples with information can be found here:

<http://www.flickr.com/photos/61377404@N08/sets/>



Ant with membracid nymphs, Georgetown, MA.

Nikon D40, PN-11 tube, Nikon 105mm f:2.5 AI-S lens, with a Rodenstock 50mm APO-Rodagon enlarging lens reverse mounted on the front. Image was flipped vertically because the subject was under the leaf. The ant was in almost constant motion, except when tapping a nymph with its antennae, "asking" for honeydew.



Katydid on sunflower, Baylor County, Texas

Nikon D60, Lester Dine 105mm macro lens. A balance of pop-up flash lighting and sunlight. The shutter speed was adjusted to render the sky visible. The body length on this guy was around 3". My sister got a number of shots of it crawling over the back of my hand before I returned it to its flower.



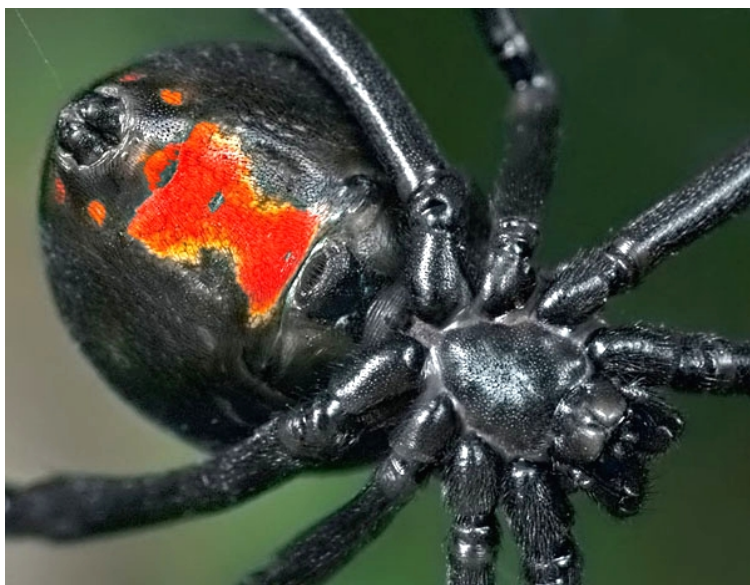
Banded Leafhopper, North Andover, MA

Nikon D40, 105mm f:2.5 AI-S lens, with a Raynox MSN-202 close up lens mounted on the front. These can be very challenging subjects! They have very keen vision and are extremely sensitive to motion detected near their perch. Often you'll only catch a shot of a back-side disappearing as it scoots away to the other side of the leaf.



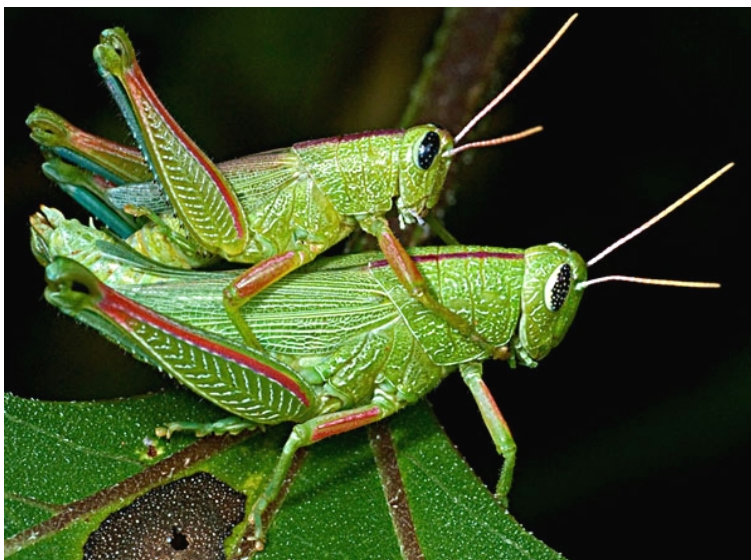
Jumping Spider, Partridge Island, Nova Scotia

Nikon D40, 105mm f:2.5 AI-S lens, 40mm Plossl telescope eyepiece reverse mounted on the front. I spotted this tiny jumping spider while slowly making my way along a stony beach, stooped over while wearing reading glasses. Usually very shy, he was one of those rare individuals who could completely ignore a huge lens hovering an inch or two in front of its face.



Western Black Widow Spider detail, Proffitt, Texas

Nikon D60, 105mm f:2.5 AI-S lens, with the front lens cell from a broken Kiron 35-135mm macro zoom lens reverse mounted on the front. This was one of several Black Widows found living in tall weeds in a cattle pasture. Although she's highly venomous, there was almost no risk involved in getting a series of shots of this gal... despite the relatively short working distance of three inches.



Mating grasshoppers, Young County, Texas

Nikon D60, Lester Dine 105 f:2.5 macro lens... no add-on lens. This colorful pair was concealed in a thicket of sunflowers in a wet area. I made rare use of a tripod... leaning on it so I wouldn't fall forward into some very unpleasant looking water while shooting a series of images.



Bee-fly, Proffitt, Texas

Nikon D40, 18-55mm zoom lens set at 55mm, with a Nikon 3-T close up lens. Shot on a very windy day, I used my left hand to steady the flower.



Mosquito ready for dinner, North Andover, MA

Nikon D40, PN-11 tube, 105mm f:2.5 AI-S lens, with a 20x Nikon Profile Projector lens (not reversed) mounted on the front. I was sitting on the back step of my garage, waiting for a mosquito to land on an area of my left arm that would allow me to operate the camera with my right hand. I popped off half a dozen shots before she flew away (without biting).



Bumblebee, Ridgewood Cemetery, North Andover, MA

Nikon D60, Nikkor-H 85mm f/1.8 lens @ f/22... focused at infinity, with an Iscorama anamorphic compression module (1968) on the 85mm, a Soligor 90-230mm objective reverse mounted on the Isco, and a Panagor 85-205mm objective reverse mounted on the Soligor.



A well-fed mosquito.

This mosquito had settled on the siding of my house after feeding. I mounted the macro bracket onto a small "Macro-bel" bellows unit fitted with a reversed Soligor Elitar 38mm f:1.9 telephoto lens from an old regular 8mm movie camera. The lens aperture was pre-set at f:8. A small LED flashlight mounted on the front bellows standard was used to provide enough light to allow focusing. By bracing myself against the wall I was able to shoot eight images, moving the camera very slightly closer with each shot. The images were processed as a stack using Helicon Focus, allowing for a much greater combined depth of field than was provided by any single image.

Are you interested???

Try building one of these rigs... you'll thoroughly enjoy what it can do for your macro shooting. The concept of using pop-up flash for macro work is sound and is open to a wide range of modification. All that's needed is a way to direct your pop-up flash lighting onto your subject, while protecting the shot from being overexposed. That's it! The free-hand, unsupported, manual (push-pull to focus) method of shooting extreme close-ups isn't for everybody. Some folks might be uncomfortable performing the "surgery" that's sometimes necessary to scavenge a good optical component from an otherwise "dead" lens.



Delicate lens surgery being performed on a lens from a dead Olympus IS-3 Delux film camera.

The techniques I've described work well with all types of macro subjects... in the studio, lab, or in the field. Anyone who has any difficulty employing any of the suggestions I've mentioned, or has any questions regarding the bracket, or macro shooting in general, should feel free to contact me. I'm always interested in seeing what other folks are doing, and am always ready to help folks work around any problems they encounter involving close-up photography.

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